

Improvement of Flood and Drought Disasters Emergency Development in Hubei Province

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Abstract

In Hubei Province agricultural natural disaster, flood and drought occurred most frequently, and the harm was the most serious, the scope of influence was the largest. In all kinds of natural disasters, flood and drought have the most extensive and serious influence on Hubei agricultural sustainable development. The specific recommendations for the prevention and mitigation of flood and drought disasters are to establish a reasonably stable into the system, perfect the legal system of disaster mitigation, and improve emergency plan system and build a reasonable management system in Hubei Province. Only the best prevention and control work can minimize disaster losses.

Keywords: emergency management, flood and disaster, AHP, countermeasures

1. Introduction

The annual number of deaths in natural disasters in the world, about 3/4 died in floods. Floods are often directly related to social stability and prosperity of the country. A statistical result that the international organization investigated the global natural disasters which occurred from 1975 to 2010, shows that the flood accounted for 50.8%, and drought accounted for 33.1% in all natural

disasters around the world. In other words, flood and drought disasters have the most extensive and serious influence on human survival. In Hubei Province agricultural natural disaster, flood and drought occurred most frequently, and their scope of influence was the largest.

Hubei Provincial science and Technology Association of disaster reduction data shows that drought and flood happen every two years, and severe drought happens three times in ten years, serious flood happens one time in five years. Over many years, the area of flood and drought disasters accounted for about 20% of the province's sown area, and about 75.57% of all agricultural disaster inundated areas. Flood and drought directly threaten agricultural high and stable yielding and the stability of agricultural systems. At the time, they also bring serious damage to the national economy, people's life and property and so on. According to incomplete statistics, by the end of August 1998, the areas of affected crops in Hubei Province had up to 2.5667 million hectares, and it was about as two times as it in 1954. The total losses accounted for 14.5% of GDP, causing direct economic losses of about 500 billion yuan. Flood and drought have become the most important factors in Hubei Province agricultural sustainable development.

2. Flood and drought disasters in Hubei Province in the recently three years

According to related statistics, Hubei Province's economic losses caused by flood and drought were increasing every year, and annual disaster losses were closed to 60 billion. Among them, the economic losses caused by water-related disasters in 2009 were 9.90 billion yuan, accounting for 0.74% of the country's total water disaster economic losses; in 2010, they were 65.47 billion yuan, accounting for 5.83%; in 2011, they were 69.01 billion yuan, accounting for 7.22%.

3. The causes of flood and drought in Hubei Province

The causes are multiple, including the following aspects:

(1) Complex geology and terrain conditions

The terrain of Hubei is geared to transition geomorphic unit zone from plateau to plain, which is roughly an incomplete basin, surrounded on West, North and East by the protrusions, among the low-lying and opening to the south. Under the influence of the terrain, water logging occurs frequently in Jiangnan Plain. With the rainstorm coming, rain flows into the plain that leads to the water levels rise rapidly. Moreover, the farmland of this area is lower than the riverbed, so the outer level is higher than the field from several meters to ten meters in each flood season, which causes the water logging inside and outside. In addition to the above effects, these areas, from the northwest through Xiangfan to the northeast, are arid, especially in the upland of Northern Hubei.

(2) The variable weather climate

Influenced significantly by the Pacific Ocean, Indian Ocean monsoon, Hubei

Province has the weather features like dry in winter and rain in summer, cold in winter and hot in summer, rain and heat in the same season, belongs to a typical subtropical monsoon zone, named as weather climate variability, the spatial and temporal changes in precipitation. The annual precipitation in most parts is 800-1600 millimetres. The summer rain is much more than the spring rain and for up to 70% -90% of the summer rain of the annual precipitation concentrated in the April-September in the whole province except the southeastern where the spring rain is slightly more than the summer rain. Bred and driven by other factors, this kind of climatic feature may form the droughts and floods disaster easily.

(3) Irregular distribution of water resources

The regional distribution of water resources in Hubei Province is not adapt to the distribution of population and plough, the eastern, southeastern and southwestern are rich in water resources, surface water resources accounts for about 40% of the total water resources in the province, but plough area accounts for only 15% of the total area of plough around; the northern is water deficient regions, surface water resources accounts for about 10%, but plough area accounts for 30%. As a result, when the flood occurs in the south of Hubei, the drought occurs in the north at the same time.

(4) Destruction of ecological system

Knocking down forest, reclaiming the remains and aimless cutting down have been the major causes to blame for the loss of land and water. It is obvious that the area of land loss, the erosion intensity and the degree of harm are all taking on a darker picture, with average increased area of land and water loss being 500 km². Moreover, serious land and water loss can easily lead to and aggravate flood and

drought. On one hand, rising of riverbed, reducing of lake silt and reservoir silting are the causes of the decline of the flood storage and discharge capacity; On the other hand, the destruction of the soil structure decreases the water conservation capacity of soil and lead to hydrological and agricultural droughts. Additionally, the storage and discharge relations have been destroyed significantly, and flood and drought have exacerbated.

(5) Low capacity of disaster prevention and resistance to disaster

The effective irrigation rate in Hubei is relatively low and currently this problem mainly refers to the arrhythmia of water conservancy projects supporting facilities, disrepair, and severity of siltation, while the investment in the farmland and water conservancy projects is insufficient. The total amount of the water conservancy projects in Hubei is insufficient, especially in the number of controlling reservoirs of major tributaries for flood prevention in Yangtze River and water conservancy projects for drought prevention in the northern and western regions of Hubei. Another defect of the capacity in agricultural disaster prevention, resistance to disaster and disaster rescue is the relatively low of the standard of flood prevention. If confronting with the flood occurring once in 100 years, there will probably be an outburst of the south and north dikes, and this will lead to a devastating disaster for the ecology, environment and social economy in plain lake area with high population density and developed economy.

4. Further analysis of the causes of the flood and drought disasters in Hubei Province

We use AHP to further analysis the cause of the flood and drought in Hubei

Province, and determine the various causes influence degrees of importance. The first reason is named for the terrain conditions (D_1), the second reason is weather climate (D_2), the third reason is the water resource (D_3), the forth reason is ecological system (D_4), the fifth reason is disaster prevention and relief capacity (D_5).

(1) Set up comparison matrix

Compare the target D_i with D_j . If D_i and D_j are equally important, then take $a_{ij} = 1$; if D_i is slightly more important than D_j , then take $a_{ij} = 3$; if D_i is obviously more important than D_j , then take $a_{ij} = 5$; if D_i is highly more important than D_j , then take $a_{ij} = 7$; if D_i is vitally more important than D_j , then take $a_{ij} = 9$; take $a_{ij} = 2,4,6,8$ if it is somewhere in the middle. The comparison matrix is shown in Table 1.

Table.1: Comparison matrix

	D_1	D_2	D_3	D_4	D_5
D_1	1	1/2	2	1/4	1/6
D_2	2	1	3	1/2	1/4
D_3	1/2	1/4	1	1/7	1/8
D_4	4	2	7	1	1/2
D_5	6	4	8	2	1

(2) Matrix solution

①First, calculate the geometric mean (β_i) of each row in comparison matrix (A). Then, normalize the vector $\beta = (\beta_1, \beta_2 \dots \beta_5)^T$ and obtain feature vector $W = (w_1, w_2, \dots, w_5)^T$.

$$w_i = \frac{\beta_i}{\sum_{k=1}^5 \beta_k} \quad (i=1,2 \dots 5) \quad (1)$$

Substitute data and obtain $\beta = (0.5296, 1.0000, 0.2949, 1.9473, 3.2875)^T$.

Feature vector: $W = (0.0750, 0.1417, 0.0418, 0.2758, 0.4657)^T$.

②Formula for calculating the largest eigenvalues.

$$\lambda_{\max} = \frac{1}{5} \sum_{i=1}^5 \frac{(AW)_i}{w_i} \quad (2)$$

Substitute data and obtain:

$$\lambda = 1/5 * (5.0117 + 5.0345 + 5.0818 + 5.0193 + 5.0857) = 5.0466$$

(3) Consistency test

The smaller Consistency Index (CI) is, the greater consistency is.

Consistency Index:

$$CI = \frac{\lambda - n}{n - 1} = \frac{5.0466 - 5}{5 - 1} = 0.0117$$

Test coefficient:

$$CR = \frac{CI}{RI} = \frac{0.0117}{1.12} = 0.0104$$

Conclusion: The test coefficient $CR = 0.0104 < 0.1$, so the comparison matrix has satisfactory consistency, and the calculated weights are effective.

(4) Analysis the results

According to the results of AHP, influence factors accounted for the proportion of total causes in Hubei Province are as follows: terrain conditions accounted for 7.50%, weather climate accounted for 14.17%, water resource accounted for 4.18%, ecological system accounted for 27.58%, disaster prevention and relief capacity accounted for 46.57%. The concrete index weights are shown in Figure 1.

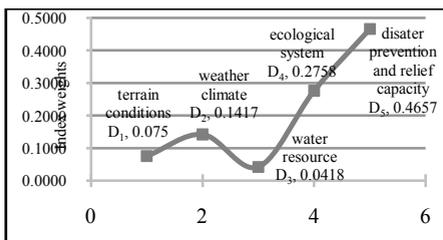


Figure 1: Each factor weight distribution of flood and drought in Hubei Province

Through the figure, we can see the disaster prevention and relief capacity,

which accounted for 46.57% of the total proportion, is the most serious factor of flood and drought disasters in Hubei Province, the second is the ecological system, accounted for 27.58%. The influence of terrain condition, weather climate and water resource distribution have small proportion in Hubei Province. Therefore, causing huge losses of flood and drought disaster, in addition to natural factors and geographical conditions, is more human factors, for example inadequate water conservancy facilities, shortage disaster prevention funding and so on.

5. Countermeasures to improve the emergency management of flood and drought disasters in Hubei Province

According to the analysis of influence factors and weights, suggestions and countermeasures are as follows:

(1) Establish reasonable and stable input system of disaster reduction

Measures should be taken to improve the water infrastructure in Hubei Province, for example increasing pre-disaster prevention spending, setting up a special fund for disaster prevention and so on. Through legislation, so that the funds of financial expenditure to prevent and resist flood and drought could be fixed, and enhance disaster reduction effectively. In addition to the provincial government, all over the city, country, etc. should also increase the investment of disaster prevention and reduction accordingly, especially for the investment of poverty-stricken areas. In order to survive, poor farmers always plunder natural resource and damage the ecological environment, the unhealthy lifestyle should be changed to solve the environmental problems fundamentally, for example forestation, watershed management and so on.

(2) Improve disaster reduction of flood and drought legal system

Related legislation, in the form of law, provides a formal basis for disaster reduction, including disaster prevention and reduction plans, institutions, measures, response actions, etc.. Then, the sound disaster prevention and reduction legal system can be clearly defined functions and roles of the various social subjects, and give full play to their respective functions of labor.

(3) Improve the emergency plan systems of flood disaster

Under the guidance and support of Hubei government, a comprehensive research related every aspect of disaster prevention and reduction can be carried out by collecting and summarizing information of each related department. The Hubei government must improve equipments and facilities of weather stations, hydrological observation stations and other disaster prediction and forecasting unit. Disaster warning systems and information reporting networks, which are built by modern communication and electronic technology, help to strengthen the equipments and capacity of disaster reduction and prevention and improve the disaster corresponding working mechanisms.

(4) Constructing reasonable flood and drought management systems

Constructing reasonable flood and drought disaster management systems need to deal with issues of decentralization and centralization. It is necessary for Hubei Province to set up an inter-departmental committee for disaster reduction, which is the comprehensive disaster reduction leader organization of the municipal governments. It can help to manage the whole organization and coordinate disaster reduction work of municipal governments comprehensively.

6. Conclusion

At any moment, regardless of what the economic and technological conditions, human activities are always important factors to affect flood and drought disasters. Social factors that lead to disasters must be solved to make the disaster prevention and reduction work of flood and drought successful in Hubei Province. The specific recommendations for flood and drought in Hubei Province are to establish reasonable reduction input system, perfect the legal system of disasters, improve the emergency plan system, and construct reasonable management system. Disaster prevention and relief measures are indispensable, and the disaster prevention should have a priority. Only the best effort to the prevention and control work, disaster losses can mitigate to the minimum.

7. References

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